

IMPROVED MASKING FOR INSULATING GLASS UNITS, MONOLITHIC PANES, AND OTHER SUBSTRATES

FIELD OF THE INVENTION

5 The present invention relates generally to protective masking material that can be applied to insulating glass units, monolithic panes, and other substrates. More particularly, this invention relates to substrates carrying advantageous configurations of masking material.

BACKGROUND OF THE INVENTION

10 In most industrialized countries, windows touch people's lives everyday. Wherever people work and live there are windows. Windows allow occupants of a building to view the outside world while allowing sun light to enter the interior of the building. Sunlight is a natural antidepressant and helps the human body produce vitamin D. Thus, a certain amount of sunshine is essential to mental and physical well being. Since windows deliver sunshine, they can be seen
15 to contribute to the mental and physical well being of the community.

Significant energy may be lost through windows during the winter when a building is being heated, and during the summer when a building is being cooled. With the rising cost of energy, efforts have been made to provide homes and other buildings with insulation that will more efficiently prevent the transfer of heat between the inside and the outside of a building.

20 High-performance monolithic panes and insulating glass units (i.e., IG units) have been developed to reduce the amount of heat transfer through windows. For example, window panes can be provided with low-emissivity coatings that reduce the transmission of radiant heat through the window. Further, IG units include a sealable space (i.e., a between-pane space) between the panes of the unit. The between-pane space provides additional insulation, and this
25 insulating effect can be enhanced by filling the between-pane space with insulative gas.

The panes of an IG unit, as well as monolithic panes, can be damaged or soiled while being transported to a building site, or during the installation and building process. The installation and building process typically involves the efforts of a variety of crafts people, such as carpenters, masons, and painters. During such processing, the pane or panes can be
5 inadvertently scratched or covered with paint, stain, or other finishing materials. Therefore, it is advantageous to temporarily mask the surface of a pane during periods of transportation, installation, and building.

Attempts have been made to provide temporary masking for the surfaces of glass panes. For example, U.S. patents 5,020,288 and 5,107,643 (both issued to Swensen) disclose a method
10 for protecting glass in doors and windows from scratches, abrasion, and painting processes. In this method, each side of each pane is covered with a protective coating material prior to its installation in a frame. After installation and all finishing has been completed, the protective material is cut away along the inside edges of the frame, leaving a residual coating of protective material along the outside edges and peripheral surfaces of each pane. This residual coating
15 material is left sandwiched between the frame and each side of each pane. The entire teachings of both of these Swensen patents are incorporated herein by reference.

The Swensen method is advantageous in that the entire surface of the pane is covered, and thus protected, by masking material. As a result, there is virtually no chance of paint or the like dripping or splattering and somehow finding its way onto unprotected areas of the pane.
20 However, it is preferable in many cases to bond the frame directly to the surface of the pane, rather than to masking material left on the outside edges and peripheral surfaces of the pane. This is believed to provide optimal bonding between the frame and the pane.

In this regard, reference is made to U.S. patents 5,599,422 and 5,866,260 (both issued to Adams, Jr. et al.), the entire teachings of each of which are incorporated herein by reference. These patents disclose a window pane protected by a single sheet of masking material that covers a central region of the pane surface, but does not cover marginal regions of the surface. When the masked pane is installed in a window frame, only the uncovered marginal regions of the pane surface are beneath the frame. Thus, the frame is bonded directly to the surface of the pane. During sanding, painting, or other finishing, the central region of the pane is protected by the masking material. After all installation and treatment procedures have been completed, the masking material is removed to expose the clean central region of the pane.

The Adams, Jr. method is advantageous in that the frame is bonded directly to the pane, rather than to masking material left on the pane. However, the inventors teach that the uncovered marginal regions must be at least as wide as the distance the frame will extend over the margins of the pane. Thus, the masking material is not to extend at all beneath the frame when the pane is installed. As a consequence, there is a risk that paint and other finishing materials may drip, splatter, or otherwise find their way onto the unmasked marginal regions of the pane. For example, if the size, shape, or positioning of the masking material is imprecise, then there will be at least some exposure of the uncovered marginal regions of the pane (e.g., between the inner edge of the frame and the outer periphery of the masking material). Even if the masking material is sized, shaped, and positioned perfectly on each and every pane, the masking material is not to extend at all beneath the inner edge of the frame. Thus, there is no over-dimensioning of the masking material, as would help ensure that paint and other finishing materials do not find their way onto the pane.

Summary of the Invention

One embodiment of the invention provides a transparent pane having first and second generally-opposed major surfaces. The transparent pane is sized and shaped to be mounted in a frame configured to receive at least one edge of the pane. The pane has a protective covering disposed over a major portion of its first surface. The protective covering comprises a plurality of strips of masking material. If so desired, the masking material may be transparent.

In another embodiment, the invention provides a transparent pane having first and second generally-opposed major surfaces. The transparent pane is sized and shaped to be mounted in a frame configured to receive at least one edge of the pane. The pane has a protective covering disposed over an oversized masked portion of its first surface. The protective covering comprises at least one piece of masking material. The oversized masked portion of the first surface has a lesser area than the first surface itself but has a greater area than an exposed central portion of the first surface that is left uncovered by the frame when the pane is mounted.

In still another embodiment, the invention provides a transparent pane having first and second generally-opposed major surfaces. The transparent pane is mounted to a frame in which at least one edge of the pane is received. The pane has a protective covering disposed over a masked portion of its first surface. This first surface has an unmasked apron extending between an outer periphery of the protective covering and an outer periphery of the pane. The protective covering comprises at least one piece of masking material and is sized, shaped, and positioned such that at least one peripheral side portion of the protective covering extends significantly beneath a confronting surface of the frame.

In yet another embodiment, the invention provides a glazing assembly comprising a transparent pane and a frame to which the pane is mounted. The transparent pane has first and

second generally-opposed major surfaces and at least one edge received in the frame. The pane has a protective covering disposed over a portion of its first surface. This first surface has an unmasked apron extending between an outer periphery of the protective covering and an outer periphery of the pane. The protective covering comprises at least one piece of masking material and is sized, shaped, and positioned such that at least one peripheral side portion of the protective covering extends significantly beneath a confronting surface of the frame.

Description of the Drawings

Figure 1 is a perspective view of an assembly in accordance with an exemplary embodiment of the present invention;

Figure 2 is a cross-sectional side view of an assembly in accordance with another exemplary embodiment of the present invention;

Figure 3 is a perspective view of an assembly in accordance with still another exemplary embodiment of the present invention;

Figure 4 is a perspective view of an assembly in accordance with yet another exemplary embodiment of the present invention;

Figure 5 is a perspective view of an assembly in accordance with a further exemplary embodiment of the present invention;

Figure 6 is a perspective view of an assembly in accordance with an additional exemplary embodiment of the present invention;

Figure 7A is a cross-sectional side view of an assembly in accordance with still another exemplary embodiment of the present invention;

Figure 7B is a cross-sectional side view of an assembly in accordance with yet another exemplary embodiment of the present invention;

Figure 7C is a cross-sectional side view of an assembly in accordance with still another exemplary embodiment of the present invention;

Figure 8 is a perspective view of an assembly in accordance with yet another exemplary embodiment of the present invention;

5 Figure 9 is a perspective view of an assembly in accordance with a further exemplary embodiment of the present invention; and

Figure 10 is a flow chart illustrating an exemplary method in accordance with the present invention.

Detailed Description of Preferred Embodiments

10 The following detailed description is to be read with reference to the drawings, in which like elements in different drawings have been given like reference numerals. The drawings, which are not necessarily to scale, depict selected embodiments and are not intended to limit the scope of the invention.

15 The present invention provides a masked pane (e.g., a window pane). As can be appreciated with reference to figure 1, the pane is typically a generally flat, sheet-like substrate. Thus, the substrate typically has two generally-opposed major surfaces, which preferably are planar and substantially parallel to each other. In most cases, the substrate will be a sheet of transparent material (e.g., a transparent pane). For example, the substrate may be a sheet of glass, clear plastic, or the like. One type of glass that is commonly used in the manufacture of
20 glass articles (e.g., insulating glass units) is soda-lime glass. Soda-lime glass is a preferred substrate. Of course, other types of glass can be used as well, including those generally referred to as alkali-lime-silicon dioxide glass, phosphate glass, and fused silicon dioxide.

Thus, there is provided a pane having first and second generally-opposed major surfaces. The pane has a protective covering disposed over at least a portion of its first surface. Preferably, the protective covering is disposed over a major portion (i.e., 50% or more) of the first surface. For example, the first surface of the pane may have an unmasked peripheral apron (described below), but otherwise may be entirely masked. In one embodiment, the protective covering is disposed over, and covers, a central portion of the first surface, which central portion spans at least 70%, and more preferably at least 75%, of the first surface. In some embodiments, the protective covering comprises a plurality of strips of masking material, as shown in figure 1. In other embodiments, the protective covering consists of a single sheet of masking material, as discussed later in this disclosure.

In certain embodiments, the transparent pane is part of a multiple-pane insulating glass unit (i.e., an IG unit). IG units are quite well known in the art. Figure 2 illustrates one example of an IG unit 36 that may be provided in connection with the present invention. The invention, however, is not limited to practice with any particular type of IG unit. To the contrary, all aspects of invention can be practiced with IG units of any type. Thus, the illustrated IG unit types are not to be construed as limiting the scope of the invention. Further, while the term insulating "glass" unit is used throughout the present disclosure, it is to be understood that the panes need not be formed of glass.

The IG unit 36 illustrated in figure 2 includes a masked first pane 2A and an unmasked second pane 2B. In more detail, the outer surface 14' of the first pane 2A carries a protective covering 20 of masking material. This protective covering 20 may consist of a single sheet of masking material, or it may comprise multiple strips of masking material, as described below. Moreover, the outer surfaces 14, 14' of both panes 2A, 2B can be masked, if so desired.

As noted above, the IG unit 36 of figure 2 includes a first pane 2A and a second pane 2B, together forming a pair of spaced-apart panes. The panes 2A, 2B bound a between-pane space 15 (i.e., an “interpane space” or a “gas space”) therebetween and an exterior space 250 thereabout. The panes 2A, 2B are preferably spaced apart in a substantially parallel relationship by a spacer 38. Peripheral inner surfaces of the panes are typically joined by the spacer. Thus, the spacer 38 and the confronting inner surfaces 24, 24’ of the panes 2A, 2B together define the between-pane space 15.

Typically, the spacer 38 is formed of a metal (e.g., aluminum) or metal alloy tubing. However, a spacer formed of plastic or another rigid material can be used. The spacer can be provided in a variety of cross-sectional configurations. For example, figure 1 depicts one spacer design that is useful. Particularly useful spacers are disclosed in U.S. patents 5,377,473, 5,439,716, 5,679,419, 5,705,010, and 5,714,214, the entire teachings of each of which are incorporated herein by reference. A wide variety of useful spacers are commercially available from known suppliers, such as Alumet Manufacturing, Inc. (Marysville, Washington, USA).

Regardless of the particular spacer configuration that is used, the spacer characteristically includes two generally-opposed lateral walls that are bonded to respective peripheral inner surfaces of the first 2A and second 2B panes. Bonding the spacer to the panes desirably forms a gas-tight seal that prevents air and other gas from entering and escaping the between-pane space. As depicted in figure 2, the interior of the spacer desirably carries a deposit of desiccant 11. The desiccant 11 can be provided in particulate form (e.g., in a granular or powdered form), to facilitate flowing the desiccant into the interior of the spacer. It is preferable to employ a low-deflection desiccant (i.e., one that minimizes the adsorption of the gases in air, particularly nitrogen). For example, desiccants containing only 3A molecular sieve, or blends of 3A sieve

and silica gel, will be suitable in most cases. Desiccants of this nature are conventional in the art and are available from a number of well known commercial suppliers.

The sealing system of an IG unit desirably minimizes gas flow between the gas space inside the unit and the ambient environment outside the unit. While some IG units have only a single seal, high performance units typically include two seals: a primary or “first” seal (i.e., the seal closest to the between-pane space) and a secondary or “second” seal (i.e., the seal farthest from the between-pane space). If present, the first seal (not shown) typically bonds the lateral walls of the spacer to peripheral inner surfaces of the panes. This seal is preferably formed of material that is resistant to permeation of air, moisture, and any insulative gas fill. For example, the first seal can be advantageously formed of a butyl sealant (e.g., polyisobutylene). As depicted in figure 2, the second seal 17 is typically applied over the outer wall 37 of the spacer. This seal 17 is preferably formed of material that has good adhesive properties. For example, the second seal can be formed of silicone, polysulfide, polyurethane, or any other material that bonds adhesively with the spacer and panes. Thus, the spacer together with the first and second seals isolates the atmosphere of the between-pane space from the ambient atmosphere.

The between-pane space of the IG unit can be advantageously filled with insulative gas. Argon is a preferred insulative gas. Krypton gives even better performance, but is more expensive than argon. Other inert gas fills can be used as well. Argon, krypton, and other inert gases are commercially available from a number of suppliers, including BOC Gases (Murray Hill, New Jersey, USA), Air Products and Chemicals, Inc. (Allentown, Pennsylvania, USA), and Air Liquide America Corporation (Cambridge, Maryland, USA).

It may be preferable to fill the between-pane space of an IG unit with a gaseous mixture of air and at least one insulative gas. The concentrations of air and insulative gas can be varied

to suit different applications. However, concentrations by volume of 80-98% argon and 2-20% air are believed to be suitable. For example, concentrations by volume of 97% argon and 3% air have given good results. Other gases (e.g., nitrogen) may be included as well. Particularly useful methods and equipment for filling IG units with insulative gas are disclosed in U.S. patents 5,957,169 and 6,158,483 (both issued to Trpkovski), the entire teachings of each of which are incorporated herein by reference.

While high performance IG units are commonly provided with insulative gas fills, many units simply contain air. Either way, the between-pane space is conventionally filled to a pressure that is equal, or as close as possible, to ambient atmospheric pressure. To the contrary, advantageous methods for intentionally over-filling (i.e., filling to a super-atmospheric pressure) or under-filling (i.e., filling to a sub-atmospheric pressure) IG units are disclosed in U.S. patent 6,216,751 (issued to Trpkovski), the entire teachings of which are incorporated herein. Thus, the between-pane space 15 may be filled to a pressure that is equal to, slightly greater than, or slightly less than, the pressure of the ambient atmosphere 250, as desired.

With continued reference to figure 2, the inner surface 24 of the first pane 2A bears an optional low-emissivity coating 40. As will be apparent to those skilled in the art, a coating of this nature can be provided on either or both of the inner pane surfaces 24, 24'. Alternatively, the low-emissivity coating 40 may be omitted entirely (e.g., both inner surfaces may be uncoated). Many useful low-emissivity coatings are well known. Particularly useful low-emissivity coatings are disclosed in U.S. patents 5,302,449 and 5,834,103, as well as in U.S. patent application 09/728,435, the entire teachings of each which are incorporated herein by reference. Other thin film coatings can be provided on one or both inner surfaces 24, 24' of the IG unit, as desired.

In the embodiment of figure 2, the outer surface 14 of the first pane 2A is masked. While the masked outer surface 14 of this pane 2A is not shown as having any thin film coating, it is anticipated that the masking material of this invention will be applied over coated surfaces of monolithic panes and IG units. Thus, the masked surface of a monolithic pane or IG unit may
5 carry its protective covering over a variety of different thin film coatings.

In certain embodiments, there is provided a monolithic pane or an IG unit having a protective covering of removable masking material disposed over a hydrophilic coating on an outer surface of the pane or IG unit. Particularly useful hydrophilic coatings are disclosed in U.S. patent applications 09/868,542, 09/572,766, and 09/599,301, the entire contents of each of
10 which are incorporated herein by reference. If so desired, the hydrophilic coating can be applied over a low-emissivity coating formed directly on an outer surface of the pane or IG unit, as described in U.S. patent application 09/868,5423, the entire teachings of which are incorporated herein by reference.

It may be particularly advantageous to provide a protective covering of masking material over a hydrophilic surface during transportation, installation, and building. For example, some of the materials (e.g., silicones and the like) that are commonly present during such processing may be particularly likely to contaminate the otherwise hydrophilic surface, rendering it less hydrophilic or even hydrophobic. Thus, one embodiment of the invention provides a monolithic
15 pane or IG unit that has a hydrophilic outer surface (e.g., a hydrophilic exterior coating) carrying a protective covering of removable masking material. The protective covering can take the form of a single masking sheet or of multiple strips of masking material. Further, the protective
20 covering can be disposed in any of the masking configurations described herein.

This embodiment is particularly advantageous, as it has been found to be surprisingly difficult to prevent a hydrophilic coating from being contaminated in such a way that the coating becomes substantially less hydrophilic. It is particularly surprising that this can occur even when the coating seems not to have been exposed to unusual contaminant levels. For example, a hydrophilic exterior coating may become contaminated during normal processing, storage, and transportation. In fact, this contamination may begin even before the coated pane has left the coating facility, storage environment, or IG unit assembly plant. Thus, it is preferred to apply the masking material as soon as possible, rather than applying it just prior to painting or other finishing of the surrounding sash, frame, etc. (which may be performed after the pane or IG unit has been installed in the wall of a building). In some embodiments, though, the protective covering is applied in one of the disclosed masking configurations to a pane or IG unit that has already been installed in the wall of a building.

One method of the invention involves: providing a monolithic pane or IG unit having a hydrophilic outer surface (e.g., bearing a hydrophilic exterior coating); and applying a protective covering of removable masking material over at least a portion of the hydrophilic surface. Preferably, the masking material is applied before the coated pane or IG unit is delivered to a building site (e.g., a construction site) or another location where the pane or IG unit is installed in its final position (e.g., before it is mounted in the wall of a building). For example, the masking material can advantageously be applied at an IG unit assembly facility. This method may further include transporting unmasked, coated monolithic panes to the IG unit assembly facility, and/or transporting masked IG units from the IG unit assembly facility to the building site or to a frame assembly facility where the masked, coated IG units (which may carry plurality of overlapped masking strips) are incorporated into sashes and/or frames. In one particular embodiment, a

plurality of masked IG units are transported from an IG unit assembly facility (optionally after being bundled, as described below) to a frame assembly facility where the IG units are incorporated into sashes and/or frames.

Figure 1 is a perspective view of an assembly 100 in accordance with one exemplary embodiment of the invention. The assembly 100 includes a pane 102 (e.g., a transparent pane) having a first surface 104, which preferably is generally planar. A protective covering 120 is disposed over at least a portion (i.e., a masked portion 122) of this surface 104. In the illustrated assembly 100, only a portion (i.e., not all) of the first surface 104 is masked. Preferably, a major portion (i.e., 50% or more) of the first surface is masked. In some embodiments, the masking material covers at least 70%, and more desirably at least 75%, of the first surface. Thus, the invention provides masking configurations wherein less than the entire first surface 104 is masked. However, the invention also provides masking configurations wherein the protective covering 120 is disposed over the entire first surface 104 of the pane. Advantageous masking configurations of both types are described below.

In embodiments like that illustrated in figure 1, the protective covering 120 comprises a plurality of strips of masking material. In such embodiments, the masking strips are preferably, though not necessarily, transparent. The strips forming the protective covering 120 can be disposed in a sequentially overlapping fashion with each subsequent strip overlapping a portion of a preceding strip. The masking strips shown in figure 1 are positioned in such a sequentially overlapped configuration. In particular, the illustrated protective covering 120 includes a first strip 130A and a second strip 130B that partially overlaps the first strip 130A. The protective covering 120 also includes a third strip 130C that partially overlaps the second strip 130B. Thus, one embodiment of the invention provides a protective covering comprising at least three, or

perhaps more preferably at least four, contiguous strips of masking material applied in a sequentially overlapped configuration. The protective covering may comprise any number of strips without deviating from the scope of the invention.

In the embodiment of figure 1, the overlapped strips of masking material are applied in a particularly desirable configuration wherein the strips are generally parallel to one another. That is, the pane 102 has a plurality of elongated masking strips extending substantially in parallel across the pane surface 104. Preferably, the overlapped strips of masking material are applied in a configuration wherein all of the strips are precisely parallel to one another. It is also preferable in many cases to apply all of the masking strips at precisely the same length. Thus, the masking strips can be applied in a configuration wherein they are precisely parallel and have precisely the same length. Masking configurations of this nature are especially advantageous in cases where the pane 102 has a square or rectangular shape. For example, a square or rectangular protective covering can be applied in this manner with a great deal of accuracy. In more detail, each peripheral edge (of the protective covering) that is defined by multiple masking strips (i.e., each composite peripheral edge 121C) can be precisely aligned by applying the overlapped masking strips in this manner. Preferably, the ends of the masking strips that define each composite peripheral edge 121C are precisely aligned with one another, such that each composite peripheral edge 121C is uniformly parallel to, and uniformly equidistant from, the adjacent edge of the masked pane. In most cases, it will be optimal to configure the protective covering such that all of its peripheral edges 121 (not just the composite peripheral edges 121C) are uniformly parallel to, and uniformly equidistant from, respective adjacent edges of the masked pane.

If provided, the overlapped strips of masking material can be configured so as to extend in any direction across the surface 104 of the pane 102. In the embodiment of figure 1, the strips

of masking material are applied such that their length (i.e., their major dimension) extends across the width of the pane surface, rather than across the length (which is greater than the width) of this surface. However, in the preferred embodiments of figures 4 and 8, the strips of masking material are applied across the length of the pane surface. The terms "width" and "length" are used herein to refer respectively to the minor dimension and the major dimension of each major surface of a generally-rectangular pane or IG unit.

As has been described, the protective covering may comprise a plurality of masking strips applied in a sequentially overlapping fashion. The amount by which adjacent masking strips overlap one another (i.e., the "masking overlap dimension") can be varied as desired. This is perhaps best appreciated with reference to figures 4, 6, and 8, wherein the masking overlap dimension is denoted by the reference character D. In these figures, the concealed lateral edge (i.e., the lateral edge covered by an adjacent masking strip) of each masking strip is denoted by dotted lines 13. The masking overlap dimension D is selected to yield a protective covering of the desired size. Skilled artisans will be able to readily select and vary the overlap dimensions of the masking strips as desired (e.g., for differently configured monolithic panes or IG units).

In one embodiment of the invention, there is provided a pane having overlapped strips of masking material that entirely cover a major surface of the pane. This is advantageous in that paint and other finishing materials have virtually no way of reaching the surface of the pane, as the entire surface is masked. In this embodiment, removal of the masking material can be performed in a number of different ways. For example, the masking material can be cut or otherwise separated along the inner edge of the frame to which the pane is mounted. The central portion of the masking material can then be removed, leaving residual masking material between the frame and marginal areas of the pane. This type of removal option is described in the above-

referenced Swensen patents. While this is a feasible option, it will be preferable not to leave residual masking material between the frame and the pane for many applications (e.g., when the masked surface is to be exposed to an outdoor environment).

Thus, it may be preferable to provide overlapped masking sheets that cover less than the entire pane surface. For example, consider that glazing compound (or "bedding material") is commonly applied between a window frame and the edge regions of each pane installed in the frame. If the glazing compound is applied to a major extent over peripheral portions of the masking material, then the masking material may be difficult to pull from the pane. For example, adhesion of the glazing compound will tend to hold the masking material to the pane. Moreover, forcibly pulling the masking material away from the pane may adversely affect the integrity of the seal provided by the glazing compound. Thus, it is preferable to size, shape, and position the masking material such that it will not end up beneath the glazing compound.

The invention provides a number of embodiments wherein a plurality of overlapped masking sheets cover less than the entire surface of the pane. For example, the first surface 104 of the pane 102 shown in figure 1 has an unmasked apron 124 (i.e., an unmasked surface area) extending between an outer periphery 126 of the protective covering 120 and an outer periphery 128 of the pane 102 (i.e., an outer periphery 128 of the pane surface 104). In embodiments of this nature, the first surface of the pane may be entirely masked other than this unmasked peripheral apron. In figure 1, the unmasked apron 124 extends between a complete outer periphery 126 of the protective covering 120 and a complete outer periphery 128 of the pane 102. That is, the entire periphery of the first surface is unmasked.

In one embodiment, a protective covering comprising a plurality of overlapped masking sheets is sized, shaped, and positioned on the pane surface such that, when the pane is mounted

to a frame, the peripheral edges of the protective covering come just to the inner edges of the frame, but do not extend beneath the frame. With reference to figures 4 and 7A-7C, this can be accomplished if the width W of the unmasked apron 324 is equal to the frame overlap dimension OD by which confronting surfaces 93 of the frame 90 extend over the surface 14 of the pane 2A.

5 With reference to figures 7A-7C, the protective covering 20 can alternatively be configured to extend at least slightly beneath the inner edges 98 of the frame 90. For example, the protective covering 20 may preferably extend significantly beneath the inner edges 98 of the frame 90, but optimally not so far as to engage glazing compound 70 between the frame 90 and the pane 2A. In one embodiment, the protective covering is configured to extend a predetermined distance X
10 beneath the inner edge of the frame. This distance X may be on the order of at least about 1/16 inch, or perhaps optimally about 1/8 inch, depending on the dimensions of the desired frame assembly. Various embodiments of this nature are described below in further detail.

Generally speaking, there are numerous ways to remove a protective covering comprising overlapped strips of masking material. For example, a person can simply grab the exposed
15 lateral edge 16 of one of the strips and pull that strip from the pane. In this manner, the strips can be removed one at a time. In some cases, all of the strips can be removed at the same time by grabbing the uncovered edge 16 of a single strip and pulling that strip away from the pane. If the overlapped strips are affixed to one another (e.g., they may be adhesively joined), then this may cause other strips to cling to the strip being pulled away from the pane. As a result, several
20 or even all of the strips may come off as an integral sheet. It will be appreciated that this removal method may be employed for any embodiments wherein the protective covering comprises overlapped masking sheets, regardless of how much of the pane surface is masked.

In prior art methods where a single sheet of masking material is used, masking too much of the pane surface can complicate removal of the masking material. For example, consider the removal of a single sheet of masking material following installation of a thus masked pane in a frame, where the masking material is configured such its peripheral edges are concealed beneath the frame. This masking material would have no readily accessible edge that a person could easily grab to pull the masking material off the pane. As a result, removal would not be particularly convenient. To the contrary, the present overlapped masking configurations inherently leave exposed edges 16 of the overlapped strips, which exposed edges 16 form readily accessible means for removing the protective covering. These overlapped masking configurations allow masking material to be configured on a mounted pane so as to extend beneath the inner edges of a frame, and yet still be easily removed.

The present masking configurations can be used in connection with a pane (which may be part of a multiple-pane IG unit) having any desired shape. For example, the major surfaces of the masked pane may have a shape that is semi-circular (e.g., having a perimeter consisting of one straight base side and one curved, semicircular side), triangular (e.g., having a perimeter consisting of three straight sides), circular (e.g., having a perimeter consisting of one circular side), or any other desired shape. In many cases, each major surface of the pane will have a polygonal shape (e.g., a square or rectangular shape) with three or more sides (e.g., four sides). In such cases, the protective covering will typically have three or more sides. As noted above, certain embodiments of the invention provide a masked pane having an unmasked apron that extends along all sides of the pane surface. However, the unmasked apron need not extend along a complete periphery of the pane surface. In fact, the invention provides numerous embodiments where the unmasked apron extends along less than a complete periphery of the pane (i.e., where

the unmasked apron extends along a partial periphery of the pane). For example, the unmasked apron 124 can be configured to extend along one, two or three sides of a square or rectangular masked surface. This may be done for a number of reasons, including to provide additional means for ultimately removing the protective covering. For example, the protective covering can be sized, shaped, and positioned such that, when the masked pane is mounted in a frame, the unmasked apron will not be entirely concealed beneath the frame. This would leave the protective covering with at least one accessible (i.e., not concealed beneath the frame) peripheral edge, such that a person could grab the exposed edge and pull the masking material off the pane.

For example, it may be desirable to provide a protective covering having an unmasked apron with a width W along one or two sides of the masked surface that is significantly greater than the frame overlap distance OD (i.e., the distance by which the confronting surface of the frame extends over the pane surface). This leaves one or two peripheral edges of the protective covering accessible following installation into the frame (i.e., one or two peripheral edges are not concealed beneath the frame). The exposed peripheral edge or edges would provide additional means for removing the protective covering, as a person could simply grab an exposed edge and pull the protective covering off the pane. Further, if two corner-defining peripheral edges of the protective covering are left exposed in this manner, then removal may be particularly convenient as an exposed corner may be easier to grab than a single exposed edge. Skilled artisans may desire other configurations where the unmasked apron extends along less than a complete periphery of the pane, and such configurations would also fall within the scope of the invention.

Figure 3 is a perspective view of an assembly 200 in accordance with an additional exemplary embodiment of the present invention. The assembly 200 comprises an IG unit 236. The IG unit 236 includes a first pane 202A, a second pane 202B, and a spacer 238 joining

peripheral inner surfaces of the first 202A and second 202B panes. The first pane 202A, second pane 202B, and spacer 238 together define a between-pane space. As noted above, the between-pane space can be filled with insulative gas (e.g., argon, krypton, and/or others). Embodiments are also possible wherein the between-pane space contains only air or vacuum. The illustrated IG unit 236 is double glazed (i.e., it has two panes). However, other IG unit constructions can be used without deviating from the scope of the invention. For example, the IG unit can be single glazed, or triple glazed, etc.

With continued reference to figure 3, the first pane 202A of the IG unit 236 has a masked first surface 204. The illustrated protective covering 220 comprises a plurality of strips of masking material disposed over the first surface 204 of the first pane 2A. In this embodiment, the overlapped strips of masking material extend across the width of the first surface 204. Preferably, the longitudinal (i.e., lengthwise) axis and/or lateral edges of each overlapped masking strip are parallel to two sides of the pane 202A and perpendicular to the other two sides of the pane 202A. However, this is by no means a requirement.

With reference to the masking material, it will be appreciated that each sheet preferably comprises a masking substrate 232 and an optional masking adhesive 234. The masking substrate 232 typically has first 206A and second 206B major surfaces, which major surfaces preferably are planar, generally opposed, and substantially parallel to each other. If provided, the masking adhesive 234 is preferably disposed over at least a portion of the first surface 206A of the masking substrate 232. However, the masking adhesive is strictly optional. For example, non-adhesive cling embodiments (e.g., shrink wrap, static cling, etc.) are anticipated. If provided, the masking adhesive preferably has a level of adhesion that is selected so the masking substrate can be easily pulled from the pane.

In certain preferred embodiments, the masking substrate 232 and the optional masking adhesive 234 are both optically transparent or translucent. Such masking embodiments tend to provide good contact clarity, which facilitates visual inspection of the masked monolithic pane or masked IG unit. In such embodiments, each pane is preferably optically transparent as well,
5 such that vision through the masked article is possible. In one embodiment, each pane is a sheet of glass and the masking material is a transparent (e.g., optically clear) polymeric material.

The masking substrate may comprise a variety of materials. For example, the masking substrate will commonly be a film (which may be flexible, yet self supporting), although paper, foil, or the like may be feasible for some applications. Polymeric films are particularly useful.
10 For example, the masking substrate can be polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polyurethane, polytetrafluoroethylene (PTFE), polyester (e.g., PET), polyamide, or polyimide. The masking substrate may also be a mixture of films, such as a co-extruded polyethylene-polypropylene film.

The masking substrate is not required to carry an adhesive (e.g., "cling" applications are possible). Preferably, though, an optional masking adhesive is disposed over one surface of the masking substrate. If provided, the masking adhesive can be a conventional pressure sensitive adhesive. It is preferable to select a masking adhesive that has minimal adhesive transfer (i.e., leaves minimal adhesive residue on the pane following removal). In certain cases, the applied masking material will require long term moisture resistance. For example, the masked surface
15 may be exposed to an outdoor environment, as would involve periodic contact with water (e.g., humidity, rain, and other precipitation). In such cases, the masking adhesive is preferably not a water-based adhesive, so as to avoid adhesive transfer and adhesive failure.

Useful masking films are commercially available from a number of suppliers, including Permacel (New Brunswick, New Jersey, USA), Poli-Film America (Hampshire, Illinois, USA), and American Biltrite Inc. (Morristown, New Jersey, USA), and Tekra Corporation (New Berlin, Wisconsin, USA).

5 In the embodiment of figure 3, only the outer surface 204 of the first pane 202A is masked. However, the outer surfaces of both panes 202A, 202B can be masked, if so desired. An alternate embodiment (not shown) provides an IG unit carrying a first protective covering (which may comprise one or multiple sheets of masking material) on the outer surface 204 of the first pane 202A and a second protective covering (which also may comprise one or multiple masking sheets) on the outer surface 204' of the second pane 202B. In another embodiment (not shown), there is provided a monolithic pane carrying a first protective covering (comprising one or more masking sheets) on one of the major surfaces of the pane and a second protective covering (also comprising one or more masking sheets) on the other major surface of the pane.

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20 Figure 4 is a perspective view of an assembly 300 in accordance with another exemplary embodiment of the present invention. This assembly 300 also comprises an IG unit 336 having a masked first pane 302A. The illustrated protective covering 320 is disposed over a masked portion 322 of a first surface 304 of the first pane 302A. In the embodiment of figure 4, the protective covering 320 comprises a plurality of strips 330 of masking material extending substantially in parallel across the first surface 304. In more detail, the strips of masking material in this embodiment extend across the length of the pane surface 304. This surface 304 also has an unmasked apron 324 between a complete outer periphery 326 of protective covering 320 and a complete outer periphery 328 of the first pane 302A. If so desired, the outer surfaces 304, 304' of both panes 302A, 302B can be masked.

Several embodiments of the invention have been described wherein generally parallel masking strips are provided on a major surface of a pane. However, the invention is by no means limited to parallel masking strip configurations. This can be appreciated by referring to figure 5, which is a perspective view of an assembly 500 in accordance with another embodiment of the invention. The illustrated assembly 500 includes a protective covering 520 disposed upon a first surface 504 of a first pane 502A of an IG unit 536. In this embodiment, the protective covering 520 includes a first horizontal strip 570A and a second horizontal strip 570B. The protective covering 520 also includes a first vertical strip 572A and a second vertical strip 572B. It can be appreciated that the first vertical strip 572A, the second vertical strip 572B, the first horizontal strip 570A, and the second horizontal strip 570B together form a protective covering 520 having outer 526 and inner 564 peripheries.

In the embodiment of figure 5, the first surface 504 of the first pane 502A has an unmasked center-most portion 514 bounded by the inner periphery 564 of the protective covering 520. In this embodiment, the first surface 504 of the first pane 502A also has an unmasked apron extending between a complete outer periphery 526 of the protective covering 520 and a complete outer periphery 528 of the first pane 502A. Thus, a bead of glazing compound can be adhered directly to this unmasked apron 522. The protective covering 520 in this embodiment is sized, shaped, and positioned to protect a portion of the first surface 504 proximate a sash or frame (not shown) in which the IG unit 536 is to be installed (e.g., during painting of the sash or frame).

In all embodiments of the invention, the protective covering (which may comprise one or multiple masking sheets) can be provided with at least one tab or extension to facilitate removing the masking material. For example, figure 6 is a perspective view of an assembly 400 in

accordance with one such embodiment. The assembly 400 includes a pane 402 having a masked first surface 404. The illustrated protective covering 420 is disposed across the first surface 404 of the pane 402. The protective covering 420 includes a first strip 430A comprising a masking substrate 432 and an optional masking adhesive 434 disposed over a first surface 406A of the masking substrate 432. In figure 6, it can be appreciated that the first strip 430A includes a first tab 458A. In more detail, the first tab 458A comprises a first portion 460 of the masking substrate 432 that is folded so as to overlap a second portion 462 of the masking substrate 432. Thus, the optional masking adhesive 434 covering the first portion 460 is adhered to the optional masking adhesive 434 covering the second portion 462. As illustrated, the protective covering 420 may also include a second strip 430B, a third strip 430C, and a fourth strip 430D. Thus, the protective covering in this embodiment (or in any other embodiment) may advantageously comprise at least four contiguous overlapped masking strips. In the embodiment of figure 6, the second strip 430B, third strip 430C, and fourth strip 430D include a second tab 458B, a third tab 458C, and a fourth tab 458D, respectively.

In another embodiment, the protective covering consists of a single sheet of masking material. In this embodiment, a single tab or extension is provided at a desired location (e.g., at a peripheral location) on the protective covering. Alternatively, a plurality of tabs or extensions may be provided at desired locations (e.g., spaced about the periphery) on the protective covering. Whether the protective covering consists of one or multiple pieces of masking material, it will be appreciated that each tab or extension can either be integral to the protective covering, or constructed separately but attached to the protective covering.

In many cases, the drawings of this disclosure show either a monolithic pane or an IG unit. It is to be understood, however, that the masking configurations described with reference to

each drawing can be applied either to a monolithic pane or to an IG unit, even though a given drawing may show one or the other (i.e., although each drawing shows either a monolithic pane or an IG unit). For example, the masking configurations described with reference to figures 1 and 6 can be applied to an IG unit, although these figures show monolithic panes. Likewise, the masking configurations described with reference to figures 2-5 can be applied to a monolithic pane, although these figures show IG units.

Several embodiments of the invention involve: providing a monolithic pane or IG unit; and applying a protective covering of removable masking material over at least a portion (e.g., a major portion) of one major surface of the pane or IG unit. The removable masking material is preferably applied as soon as possible, rather than just before painting or otherwise finishing a surrounding sash, frame, wall, etc. (which finishing may be performed after the pane or IG unit has been mounted, such as in the wall of a building). However, some embodiments of the invention do involve applying one of the disclosed masking configurations to a pane or IG unit that has already been installed in the wall of a building.

Certain methods of the invention include the following: providing a plurality of monolithic panes; delivering the panes to an IG unit assembly facility; and assembling the panes into multiple-pane IG units and applying removable masking material to an outer major surface of each IG unit before the IG units leave the assembly facility. In this method, the masking material may be applied on an assembly line in the IG unit assembly facility. In some cases, the masking material comprises a plurality of overlapped masking strips (which preferably cover a major portion of the pane surface). The masked IG units may then be transported to a building site (e.g., a construction site) or another location where the masked IG units are installed in their final positions (e.g., in the walls of a building). Alternatively, the masked IG units may be

transported to a frame assembly facility where they are incorporated into sashes and/or frames. Either way, the masked IG units may be bundled (e.g., they may be packed for shipment and/or secured upon pallets, crates, or glass racks, such as those described in U.S. patent 6,102,206, the entire teachings of which are incorporated herein by reference).

5 Several embodiments of the invention involve glazing assemblies wherein a masked monolithic pane or masked IG unit is mounted to a frame. The masked pane or IG unit can be installed in a variety of different types of frames. It is to be understood that the term "frame" is used herein to refer to any structure (e.g., a sash, frame, frameless glazing, or the like for a window, door, skylight, etc.) to which a monolithic pane or IG unit may be mounted. Most
10 conventional frames are configured to receive at least one edge (and commonly all edges) of the pane or IG unit. In certain embodiments, the frame is adapted to retain the pane or IG unit in a generally-vertical configuration (e.g., as a window or door). In other embodiments, the frame is adapted to retain the pane or IG unit in a generally-horizontal configuration (e.g., as a skylight). As described below, the size, shape, and positioning of the protective covering is preferably
15 selected to accommodate installation in the desired frame.

 The invention provides a number of particularly advantageous masking configurations that accommodate installing a masked monolithic pane or a masked IG unit into a frame. These masking configurations can be utilized in embodiments where the protective covering consists of a single sheet of masking material, as well as in embodiments where the protective covering
20 comprises multiple sheets (e.g., overlapped strips) of masking material. Thus, in describing the following masking configurations, it is to be understood that the protective covering may either take the form of one or multiple sheets of masking material.

When a masked monolithic pane or a masked IG unit is mounted to a frame, it is advantageous if the peripheral side portions of the protective covering extend at least slightly beneath the frame. This helps assure that paint and the like cannot easily reach the pane. At the same time, it may be optimal if the peripheral edges of the protective covering do not engage glazing compound between the frame and the pane. This helps assure that the masking material will not become adhered to such glazing compound. It may be difficult to assure that, in all cases, the edges of the protective covering do not engage glazing compound anywhere beneath the frame. However, the protective covering is preferably configured such that its edges do not extend to any major extent beneath the glazing compound. This helps assure that the masking material will not become trapped stubbornly under the glazing compound. As noted above, the glazing compound may be damaged if it is sealed to a major extent over the masking material when such masking material is pulled away from the pane.

In one embodiment of the invention, there is provided a transparent pane having a protective covering disposed over an oversized masked portion of the pane surface. The pane is sized and shaped to be mounted in a frame configured to receive at least one edge of the pane. The oversized masked portion of the pane surface has a lesser area than the pane surface itself. That is, the masking material does not entirely cover the pane surface. However, the oversized masked portion has a greater area than the exposed central portion of the pane surface that is left uncovered by the frame when the pane is mounted. Thus, the protective covering in this embodiment is deliberately configured to extend at least slightly beneath the frame. Preferably, the oversized masked portion has a significantly greater area than the exposed central portion (or the "vision area"), so as to assure that paint and the like cannot easily reach the pane

In this embodiment, the pane may have an unmasked apron between an outer periphery of the protective covering and an outer periphery of the pane. The unmasked apron preferably extends along all sides of the pane surface, such that a complete periphery of the pane surface is unmasked. Optimally, the unmasked apron has a width W along all sides of the pane surface that is less than the frame overlap distance OD by which confronting surfaces 93 of the frame 90 extend over the pane surface. This leaves all peripheral edges 21 of the protective covering concealed beneath the frame. At the same time, the protective covering preferably does not extend so far beneath the frame as to be sealed under (and perhaps optimally not so far as to engage) glazing material between the frame and the pane.

This is perhaps best understood with reference to figure 7A, wherein a masked IG unit 36 is shown mounted to a frame 90. This figure depicts one edge of the masked pane 2A that is received in the frame 90. However, it will be appreciated that the IG unit 36 may be mounted such that all edges of each pane are received in the frame 90. Moreover, the frame 90 may alternatively be adapted to carry a masked monolithic pane (i.e., the width of the glazing channel may be configured to receive a monolithic pane, rather than a multiple-pane IG unit).

In the embodiment of figure 7A, the protective covering 20 is preferably sized, shaped, and positioned such that at least one peripheral side portion 23 of the protective covering 20 extends significantly beneath a confronting surface 93 of the frame 90. Thus, the protective covering in this embodiment is deliberately configured such that at least one peripheral edge 21 of the protective covering is concealed beneath the frame. In more detail, the peripheral edge 21 is preferably positioned between the innermost portion of the glazing compound 70 and the inner edge 98 of the frame 90. For example, the protective covering can be configured such that at least one of its peripheral side portions 23 extends a predetermined distance X beneath a

confronting surface 93 of the frame 90. A particularly desirable degree of protection against paint and other finishing materials may be achieved if this distance X (whether or not predetermined) is at least about 1/16 inch. For example, a distance X of about 1/8 inch should give good results for many frame assemblies.

5 In certain particularly preferred embodiments, the protective covering 20 is sized, shaped, and positioned such that all peripheral side portions 23 of the protective covering 20 extend significantly beneath confronting surfaces 93 of the frame 90. For example, the protective covering can be configured such that all of its peripheral side portions 23 extend a predetermined distance X beneath confronting surfaces of the frame. As noted above, this distance X (whether or not predetermined) may advantageously be at least about 1/16 inch, and a distance X of about 10 1/8 inch should give good results for many frame assemblies. This embodiment provides exceptional masking protection, as each peripheral edge 21 of the protective covering 20 is concealed beneath the frame 90.

15 In figure 7A, the protective covering 20 does not extend so far beneath the confronting surface 23 of the frame 90 as to engage the glazing compound 70 between the frame 90 and the pane 2A. As noted above, this helps assure that the masking material will not become adhered to the glazing compound. While this may be ideal, the masking material in some embodiments may extend so far beneath the frame as to come into contact with (e.g., abut) the glazing compound. In such embodiments, it is preferable that the masking material not extend so far as 20 to become sealed under the glazing compound. As noted above, this helps assure that the masking material will not become trapped beneath the glazing compound, such that the glazing compound is not damaged when the masking material is ultimately removed from the pane. Though decidedly less preferred, it may be feasible to configure the protective covering such that

it is somewhat sealed beneath the glazing compound. However, the protective covering in all cases preferably does not extend beneath the glazing compound to a major extent, as would leave the masking material stubbornly sealed beneath the glazing compound (as may require severing a peripheral portion of the protective covering and leaving it between the pane and the glazing compound). Preferably, the protective covering 20 is sized, shaped, and positioned such that all of its peripheral side portions 23 extend significantly beneath confronting surfaces 93 of the frame 90, but not so far as to become stubbornly trapped under (perhaps optimally so as not to engage) glazing material between the frame and the pane.

In certain embodiments, the protective covering is sized, shaped, and positioned such that a single peripheral side portion 23 thereof extends at least slightly beneath a confronting surface 93 of the frame 90. For example, the protective covering can be configured such that only its peripheral bottom side portion (i.e., the peripheral side portion adjacent the bottom leg of the frame) extends beneath the confronting surface of the bottom leg of the frame. Paint and other finishing materials may drip toward the bottom of a masked pane, making the bottom margins of the pane more likely to become contaminated. Thus, it may be especially beneficial if the bottom of the protective covering extends at least slightly beneath the frame. Alternatively, the protective covering can be configured such that only its peripheral top side portion (i.e., the peripheral side portion adjacent the top leg of the frame) extends beneath the confronting surface of the top leg of the frame. For example, the confronting surface 93 of the top leg of the frame 90 may be configured to bear snugly against the top of the protective covering. This may be particularly beneficial for applications where the protective covering is likely to slide down the pane over time (e.g., if the protective covering is to remain on the pane for a long period of time, if the protective covering is to be exposed to rigorous environmental conditions, if the protective

covering is applied with a weak adhesive or without adhesive, and/or if the protective covering is formed of a heavy masking material).

The glazing assembly 99 depicted in figure 7A includes an IG unit 36 and a very basic frame 90 in which the IG unit 36 has been mounted. The illustrated frame 90 includes a base 95 (defining a base mounting surface 95S) and two shoulders 96, 96I (defining confronting mounting surfaces 93), together defining a glazing channel in which the edge of the IG unit 36 is received. As noted above, the frame 90 may be adapted to receive a masked IG unit (as shown) or a masked monolithic pane. The shoulders 96, 96I of the frame 90 provide glazing stops, which hold the IG unit 36 in place. In the illustrated frame embodiment, one of the illustrated frame shoulders 96I is integral to the frame base 95, while the other 96 is separately constructed. In figure 7A, masking material is only provided on the first pane 2A. However, masking material may alternatively, or additionally, be placed upon the second pane 2B.

The frame 90 can be provided in many different forms. For example, the frame 90 may have a tubular construction (e.g., of metal, metal alloy, plastic, etc.), or it may comprise vinyl-covered wood or the like. In particular, the design of the separately-constructed shoulder 96 will tend to vary with different manufacturers. In some cases, the frame 90 may include a glazing jamb that snaps or slides (not shown) into the position occupied in figure 7A by the separate frame shoulder 95S. In such cases, there may or may not be glazing compound between this jamb 955 and the outer surface of the adjacent pane. In cases where no such glazing compound is applied, it may be desirable to configure the masking material so as to extend a further distance X beneath the inner edge 98 of this jamb 955 than would be desirable in cases where glazing compound is applied between this jamb 955 and the pane. A variety of other frame designs are possible, and would also fall within the scope of the invention.

With continued reference to figure 7A, the illustrated assembly 99 includes a bead of glazing compound 70 disposed between the frame 90 and edge regions of the panes 2A, 2B. In Figure 7A, the glazing compound 70 is located between the outer surfaces 14, 14' of both panes 2A, 2B and both confronting mounting surfaces 95 of the frame 90, as well as between the base mounting surface 95S of the frame 90 and the peripheral end of the IG unit. However, the manner of applying glazing compound 70 will vary from one manufacturer to the next. For example, Figures 7B and 7C illustrate embodiments wherein the glazing compound 70 has only been applied between the frame and the outer surface of one of the panes.

With reference to figure 7B, the glazing compound 70 is located between the frame 90 and the outer surface 14 of the first pane 2A, but not between the frame 90 and the outer surface 14' of the second pane 2B. In figure 7B, masking material is provided only on the first pane 2A. However, in some cases, masking material may additionally, or alternatively, be provided on the second pane 2B. In such cases, it will be appreciated that the masking material can typically be pulled from between the frame shoulder 95S and the pane 2B without difficulty, although figure 7B does not depict any space between the shoulder 95S of the frame and the second pane 2B. This will be apparent in light of the discussion below regarding installation of a pane or IG unit into the frame 90. In figure 7B, the glazing compound 70 is located between the peripheral end of the IG unit 36 and the base mounting surface 95S of the frame 90, although this is by no means a requirement. For example, figure 7C illustrates an embodiment wherein the glazing compound 70 is not applied between the peripheral end of the IG unit and the base mounting surface 95S of the frame 90.

By referring to figures 7A-7C, it can be appreciated that the IG unit may only be affixed in its position by adhesion of the glazing compound. That is, the IG unit would rest unfixed in

the glazing channel if adhesion of the glazing compound were to fail. It can also be appreciated that adhesion of masking material to glass may be substantially weaker than adhesion of glazing compound to glass. Therefore, leaving some masking material permanently beneath the glazing compound may not be desirable, particularly in cases where the masked pane is exposed to wind loads and periodic contact with water (e.g., rain and other precipitation).

Any conventional glazing compound can be used in connection with the invention. For example, a variety of useful glazing compounds are commercially available from known suppliers, such as Dow Corning Corporation (Midland, Michigan, USA).

The manner of installing a monolithic pane or IG unit in a frame is well known in the art. With reference to figure 7A, prior to attaching the separate frame shoulder 96 to the frame 90, a bead of glazing compound 70 can be applied to the glazing channel. The edge of the pane or IG unit (which is preferably, though not necessarily, already masked) can then be fitted against the integral shoulder 96I of the frame 90. Finally, the separate frame shoulder 96 can be attached to the base 95 of the frame 90, thus securing the edge of the monolithic pane or IG unit within the glazing channel. Variants of this process will be obvious to those skilled in the art.

As noted above, the masked monolithic pane or masked IG unit can be incorporated into a sash. For example, figure 8 is a perspective view of an embodiment wherein the assembly of figure 4 has been incorporated into a sash 354 (e.g., a window sash). In the assembly of figure 8, the sash 354 has been positioned over an IG unit 336, although a monolithic pane can also be thus encased in a sash. In this embodiment, it can be appreciated that the sash 354 includes a plurality of inside edges 356. As described above with reference to figure 7, the protective covering 320 can have a variety of different masking configurations. For example, the protective covering 320 (which is depicted as comprising a plurality of overlapped masking strips) can be

configured to extend just to the inner edges 356 of the sash 354, such that the outer periphery 326 of the protective covering 320 is aligned with the inner edges 356 of the sash 354.

Alternatively, the protective covering 320 can be configured to extend at least somewhat beneath the inner edges 356 of the sash 354. In such an embodiment, the protective covering may be a single sheet of masking material, or it may comprise a plurality of masking strips, as illustrated. Preferably, the protective covering 320 does not extend so far beneath the inner edges 356 of the sash 354 as to become sealed stubbornly beneath glazing compound (not shown) between the sash and edge regions of each pane.

Figure 9 is a perspective view of an assembly 800 in accordance with another exemplary embodiment of the invention. The illustrated assembly 800 includes a sash assembly 801 that has been installed in the wall 867 of a building 868. The sash assembly 801 comprises an IG unit and a sash 854. It can be appreciated that the masked pane (which may carry a single masking sheet as described above, or multiple masking strips, as shown) of the IG unit 836 will be protected against becoming contaminated with paint or other finishing materials that may be applied to the walls 867 of the building 868, to the sash 854, or to other nearby structure. Alternatively, a pane or IG unit can be installed directly into a frame without utilizing any sash.

The invention provides simplified processes for applying masking material to panes of varying size. For example, a supply (e.g., a roll) of masking material can be selected such that the width of the masking material corresponds to a known minimum pane size. In one embodiment, there is provided a roll of masking material having a width that corresponds to (e.g., is slightly less than) the width of a known minimum pane size. Thus, when it is desired to mask a pane of the minimum size, the whole protective covering can be formed by a single sheet of the masking material (i.e., a single length of the masking material can be applied to cover the

entire masked portion of the pane). On the other hand, when it is desired to mask a larger pane, the protective covering can be formed by applying multiple sheets of the masking material in the overlapping fashion described herein. The number of sheets applied, and the masking overlap dimension of the sheets, are selected to achieve the desired coverage of the pane surface.

- 5 Whether one or multiple sheets of masking material are applied, the length of each sheet is preferably selected to correspond to (e.g., to be slightly less than) the length of the pane.

Thus, it can be appreciated that a supply of masking material can be conveniently used to mask panes of many different sizes. For example, the present method avoids the need to stock rolls of masking material of different widths to accommodate panes of different size. In fact, it is only necessary to stock rolls of masking material having a single width corresponding to a known minimum pane size. Moreover, in embodiments where an unmasked apron is left on the pane surface, the masking material can be applied without having to cut or otherwise affirmatively remove marginal portions of the protective covering. This affords significant efficiency in terms of time, labor, and money. It also prevents any damage that might otherwise be done to the pane surface during removal (e.g., cutting) of marginal portions of the masking material. This may be particularly advantageous in cases where the masked surface bears an exterior coating, which may be vulnerable to abrasion by cutting wheels and the like.

Figure 10 is a flow chart illustrating an exemplary method in accordance with the present invention. The method of figure 10 includes a step of providing a monolithic pane or IG unit to be masked. For example, this step may include the step of providing an IG unit having a first, outer surface. The method of figure 10 also includes the step of providing a desired width of the masked area to a masking calculator. For example, a monolithic pane or IG unit may be moved into a masking station. In the masking station, a dimension of the pane or unit may be detected

or input by an operator. A controller associated with the masking station may utilize this dimension to determine a masked area corresponding to a pane or IG unit having that dimension.

The method of figure 10 also includes the step of providing masking material having a width. In a preferred method, the width of the masking material is selected to correspond to the width of a masked area of a small monolithic pane or IG unit. In this preferred method, a small pane or IG unit can be masked by applying a single strip of masking material to a surface of the monolithic pane or IG unit. Panes and IG units having a dimension larger than the small pane or IG unit can be masked using multiple strips of masking material.

The method of figure 10 also includes the step of determining an optimal number of strips. As described above, for a small monolithic pane or IG unit, the optimal number of strips may be one. For other panes and IG units, multiple strips may be desired. The method of figure 10 also includes the step of calculating a masking overlap dimension D. The width of the masking material and the optimal number of strips may be used to calculate useful overlap dimensions D to achieve the desired coverage of the masked area.

The method figure 10 also includes the step of applying the optimal number of strips. For example, the optimal number of strips of masking material may be applied to a first, outer surface of a monolithic pane or IG unit. In one method in accordance with the present invention, the strips are applied in a sequential fashion with each subsequent strip partially overlapping the preceding strip by the calculated masking overlap dimension D.

It is to be appreciated that various embodiments of a window assembly may be used without deviating from the spirit and scope of the present invention. A window assembly may comprise, for example, a monolithic pane, and/or an insulating glass unit, and/or a window sash. In certain embodiments, the described methods include the step of transporting the window

assembly to a building site. These methods may also include the step of installing the window assembly (e.g., into a window frame or the like). The step of installing the window assembly may include the step of attaching the window assembly to a frame, as described above.

Following installation, a sash, nearby frame, or other surrounding structure can be painted or otherwise finished. During such processing, the protective covering conceals the masked surface of the pane, thereby preventing paint and the like from being inadvertently applied to this surface. When installation, painting, and other finishing is complete, the protective covering can be removed from the surface of the pane. Thus, the protective covering can protect the masked surface of the pane during transportation, installation, finishing (e.g., painting), and even during manufacturing (e.g., assembling the pane or IG unit into a sash).

Several forms of invention have been shown and described, and other forms will now be apparent to those skilled in the art. It will be understood that the embodiments shown in the drawings and described above are merely for illustrative purposes, and are not intended to limit the scope of invention.